

36 Effects of nicotine and nicotine withdrawal on local cerebral glucose utilization

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In previous studies we have investigated the effect of an acute (1) and a 2 weeks' (2) chronic infusion of nicotine on local cerebral glucose utilization (LCGU). LCGU is accepted to serve as an indicator of the local functional activity in the brain and was measured in awake rats in the previous studies as well as in the present investigation using the quantitative 2-deoxy D-(1-¹⁴C) glucose method of Sokoloff et al (3). The present investigation was designed on the basis of two previous findings: 1. Chronic infusion of nicotine results in an increase in nicotine binding sites in the brain. This has been found by several groups. 2. Chronic infusion of nicotine, when compared to an acute infusion, induces partly congruent and partly divergent effects on LCGU in different brain structures (2). This led us to the question, whether a withdrawal of nicotine after a 2 weeks' exposure would restore the brain function (LCGU) to the preinfusion values within one day and whether an acute infusion after one day's withdrawal would influence LCGU. The main results of these studies are: a one day withdrawal of nicotine after a 2 weeks' chronic infusion restores LCGU in several brain structures: a pattern of LCGU which is close to control conditions is obtained. An acute infusion of nicotine after a one day withdrawal of a chronic infusion induces distinct increases in LCGU of several structures which had also been activated during an acute infusion of nicotine in otherwise untreated rats (no chronic infusion). The data indicate that the main effects of chronic nicotine infusion on cerebral function have disappeared after one day of nicotine withdrawal and that an acute load of nicotine in such nicotine-withdrawal rats has effects on LCGU which are rather close to those found in previously untreated rats.

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3. Sokoloff,L., Reivich,M., Kennedy,C. et al. J. Neurochem. 28, 897-916, 1977

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